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ABSTRACT

This training unit on portable extinguishers is part of a 17-unit course package written to aid instructors in the development, teaching, and evaluation of fire fighters in the Wisconsin Fire Service Certification Series. The purpose stated for the 8-hour unit is to familiarize fire fighters with all types of extinguishers. An instructor's guide sheet provides this information: introduction to the topic, instructor preparation, length of unit, methods of instruction, testing, equipment and facilities required, recommended visual aids, and references. Following a list of unit objectives, a lesson plan outlines the main teaching points and states the preferred teaching method, cites the reference and page number(s) where the information is to be found, and indicates the necessary handouts. Other contents in the unit include a unit quiz, answer key to the quiz, and handouts (graphs, student worksheets, informational material, and forms). (YLB)

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FIRE SERVICE CERTIFICATION SERIES

UNIT FSCS-FF-4-80

PORTABLE EXTINGUISHERS

UNIT FSCS-FF-5-80

ROPE PRACTICES

FIRE SERVICE TRAINING

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PORTABLE EXTINGUISHERS

Prepared by:

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Fire Service Training

INTRODUCTION

Portable fire extinguishers are used as a first-line defense mechanism on fires of limited sizes. Even in premises protected by other fire control devices, the value of extinguishers should be recognized and appropriate units should be available.

It is imperative that firefighters be familiar with all types of extinguishers for their own useage as well as to educate the public.

Educating the public on portable fire extinguishers is a good fire prevention investment in addition to being an excellent public relations tool for the fire department

The firefighter should be educated on the type extinguishers available, their methods of operation, the marking of extinguishers and placement.

This unit is designed to give the firefighter this knowledge.

INSTRUCTOR PREPARATION

Carefully study the objectives to determine the gaols that have been set for the firefighters upon completion of this unit.

Review the lesson plans and if necessary, consult the references listed.

Develop suitable audio-visual aids, provide training area and necessary tools and equipment to effectively teach this unit.

LENGTH OF UNIT

Classroom Work	4 hours
Practical Skills	3 hours 30 minutes
Evaluation and Testing	30 minutes

METHODS OF INSTRUCTION

Illustration and Demonstration

Suggested methods and techniques are listed under Instructor's Notes on the lesson plans. For further information consult Fire Service Instructor Training IFSTA #303 3rd ed., pp. 71-83.

TESTING

At the end of this unit, a written quiz of five or more questions will be given.

EQUIPMENT AND FACILITIES REQUIRED

Appropriate training aids and necessary equipment.
Actual fire extinguishers. As many different kinds as are available.
Adequate supplies for recharging extinguishers.

REFERENCES

1. Peige, J., Ed., Forcible Entry, Rope and Portable Extinguisher Practices, #101 IFSTA, Stillwater, 6th ed., 1978 pp. 147-189

2. Peige, J., Ed., Essentials of Fire Fighting, #200 IFSTA, Stillwater, 1st ed., 1977, pp. 12-23 179-182

3. Williams, C. and Laughlin, J., Ed., Aircraft Fire Protection and Rescue Procedures, #206, IFSTA, Stillwater, 2nd ed., 1978, pp. 132-140

4. Mckinnon, G. and Tower, K., Ed., Fire Protection Handbook, National Fire Protection Association, Boston, 14th ed., 1976, pp. 13-2 to 13-34, 16-2 to 16-8, 16-18 to 16-25

OBJECTIVES

All objectives in this unit are to be met according to the material contained in the International Fire Service Training Association Manuals #200 Essentials of Fire Fighting and #101 Forcible Entry Rope and Portable Extinguisher Practices.

To satisfactorily complete this unit, the firefighter must attain a grade of 70 or higher on the written quiz and successfully complete the practical skills examination.

NFPA STANDARD 1001

PORTABLE EXTINGUISHERS

FIRE FIGHTER II

4-16 Portable Extinguishers

4-16.1 The fire fighter shall demonstrate a knowledge of the Chemistry of Fire.

4-16.2 The fire fighter shall identify the classification of types of fires as they relate to the use of portable extinguishers.

4-16.3 The fire fighter, given a group of differing extinguishers, shall demonstrate the appropriate extinguishers for the various callses of fires.(covered in practical skills test Unit 4)

4-16.4 The fire fighter shall identify the extinguisher rating system.

COURSE: FIRE SERVICE CERTIFICATION SERIES

LESSON: PORTABLE EXTINGUISHERS

EQUIPMENT NEEDED: SLIDE, OVERHEAD OR MOVIE PROJECTORS, SREEN

TRAINING AIDS: SLIDES, TRANSPARENCIES, FILMS, TEXTS, CUTAWAYS, EXTINGUISHERS

INSTRUCTORS NOTES	TEACHING POINTS
4-16 Portable Extinguishers 4-16.1	Chemistry of Fire A. Fire Tetrahedron 1. Oxygen - oxidizing agent a. 21 % in air b. 15-16% for free burning with visible flame c. 8% or below - combustion stops d. Oxygen does not burn, it supports combustion e. Some fuels contain their own oxygen 2. Fuel - Reducing Agent a. Three physical states - solid, liquid and gas b. Size and shape of fuel particle influences ease of ignition and rate of burning c. Vaporization needed to burn most fuels 3. Heat a. Sources of ignition b. Ignition temperatures c. Vaporization d. Pyrolysis 4. Uninhibited Chain Reaction a. Chemical reactions occur during burning process

INSTRUCTORS NOTES	TEACHING POINTS
	Chemistry of Fire 4. Uninhibited Chain Reaction b. New products are formed during burning. These products may or may not burn.
4-16 PORTABLE EXTINGUISHERS 4-16.2 Ref: Forcible Entry, Rope and Extinguisher Practices IFSTA #101 p. 150	Classification of Fires Before a firefighter can select the type of extinguisher needed to protect a certain hazard, they must know the type of potential fire that hazard constitutes. There are four classes of fire which include: Class A Fires - defined as fires involving ordinary combustible materials such as wood, cloth or paper. Class B Fires - defined as fires involving flammable liquids, greases and gases. Class C Fires - defined as fires involving energized electrical equipment. Class D Fires - defined as fires involving combustible metals such as magnesium, titanium zirconium, sodium and potassium.
4-16 PORTABLE EXTINGUISHERS 4-16.3 pp. 172-189	Use and Operation of Portable Extinguishers Portable extinguishers come in many shapes, sizes and types. The firefighter must be able to choose the correct size and type of extinguisher for any particular fire. When the proper extinguisher is in hand, the operating principles of each type are similiar. The firefighter should be familiar with the operating instructions found on the label of the extinguisher. Therefore everyone should be acquainted with the following general instructions applicable to most portable extinguishers. These instructions follow the letters P - P - P - S

INSTRUCTORS NOTES

TEACHING POINTS

pp. 172-189

Use and Operation of Portable Extinguishers

Modern extinguishers are designed to be carried to the fire in an upright position.

When instructing the general public in the use of extinguishers, it should be STRONGLY EMPHASIZED that they are operated in the upright position.

Only obsolete soda-Acid, foam and cartridge operated water extinguishers are designed to be turned upside down. AVOID THERE USE IF POSSIBLE.

Do not attempt to activate the extinguisher until close enough to the fire to be within the reach of the stream of that extinguishing agent. Smaller extinguishers require a closer approach to the fire.

P - P - P - S

P - Pull the pin at the top of the fire extinguisher which keeps the handle from being preseed. Break the thin wire or plastic inspection band.

P - Point the nozzle or outlet towar the fire. Some hose assemblies are clipped to the extinguisher body. Release it and point

P - Press the handle above the carrying handle to discharge the agent isnide. The handle can be released to stop the discharge at any time.

Note: The lever may be at the top or at the nozzle and also a cartridge may have to be started.

S - Sweep the nozzle back and forth before the flames to spread out the extinguishing agent. Apply it toward the base of the flames. After the fire is out, probe fo remaining smouldering hot spots or possible reflash of flammable liquids. Make sure the fire is out.

PULL PIN - POINT NOZZLE - PRESS HANDLE - SWEEP AGENT BCK AND FORTH.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: 172-189

USE AND OPERATION OF PORTABLE EXTINGUISHERS

A. Water Based

1. Pump Tank Water Extinguishers

a. Size 1½ to 5 gallon

b. For use on Class A fires

c. Range 30-40 feet

d. Duration 45 seconds to 3 minutes

e. Protect from freezing

f. Operation - Hand-pump operated

2. Stored-Pressure Water Extinguishers

a. Size 2½ gallon

b. For use of Class A Fires

c. Range 30-40 feet

d. Duration-approximately 1 minute

e. Protect from freezing unless antifreeze solution has been added

f. Operation - Air pressurized

CAUTION: must be used because internal pressure build-up may cause container to rupture.

3. Soda-Acid - Have not been manufactured since 1969

a. Size 2½ to 40 gallons

b. For use on Class A Fires

c. Range 20-40 feet

d. Duration 1 minute

e. Protect from freezing

f. Operation

(1) Sodium bicarbonate solution mixes with sulfuric acid and carbon dioxide is produced when inverted and is the expelling force.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 172-189

CAUTION must be used because internal pressure build-up may cause container to rupture.

WHEN EVER POSSIBLE AVOID THE USE OF THIS TYPE OF EXTINGUISHER.

USE AND OPERATION OF PORTABLE EXTINGUISHERS

A. Water Based

4. Foam - Have not been manufactured since 1969

   a. Size 2½ to 40 gallons

   b. For use on Class A Fire - special application
      For use on Class B Fires

   c. Range - Varies with operator

   d. Duration - varies

   e. Protect from freezing

   f. Operation

      (1) When extinguisher is inverted the aluminum sulfate in the inner chamber and the sodium bicarbonate in the outer chamber mix and create carbon dioxide which is the expelling agent.

   g. expansion ration 8 to 1

5. Aqueous Film Forming Foam Extinguisher

   a. Size 2½ gallons

   b. For use on Class A & B Fires

   c. Pange 30 feet

   d. Duration 60-65 seconds

   e. Protect from freezing

   f. Operation - Air pressurized

   Note: The 2½ gallon extinguisher should only be recharged with a special kit by experienced personnel to insure the proper mextures in the solution.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 172-189

B. Halogenated Hydrocarbons - liquified gases

6. Halon 1211 Extinguishers - Bromochlorodifluromethane
Halon 1301 - Bromochlorodifuromethane
a. Size 2½ to 25 pounds

b. For use on Class B & C Fires

c. Range 4 to 10 feet

d. Duration 8 to 25 seconds

e. Operation - Internal pressure

C. Carbon Dioxide

7. Carbon Dioxide Extinguishers

a. Size 2½ to 5 pounds, 10 to 15 pounds, 20 pounds

b. For use on Class B & C Fires

c. Range 3 to 8 feet

d. Duration 8 to 30 seconds

e. Operation - Internal pressure

Wheeled Types

a. Size 50, 75, and 100 pounds

b. For use on Class B & C Fires

c. Range 8 to 20 feet

d. Duration 30 to 80 seconds

e. Operation - Internal pressure

f. Hose length 15 feet

D. Dry Chemical

8. Dry Chemical Extinguishers - Ordinary Base

a. Size 2½ to 30 pounds

b. For use on Class B & C Fires

c. Range 5 to 20 feet

d. Duration 10 to 25 seconds

INSTRUCTORS NOTES

TEACHING POINTS

Ref; pp. 172-189

D. Dry Chemical

8. Dry Chemical Extinguishers - Ordinary Base

e. Operation - Internal pressure either dry air, nitrogen or carbon dioxide

NOTE: The agents in these units are comprised of

sodium bicarbonate
potassium bicarbonate
ammonium phosphate
potassium chloride

which has been chemically processed to make it moisture resistant and free flowing.

DO NOT MIX AGENTS - REFILL UNITS WITH THE AGENT DESIGNATED FOR USE IN THAT TYPE OF EXTINGUISHER

Wheeled Units

a. Size 75 to 350 pounds

b. For use on Class B & C Fires (Classes A & D when noted)

c. Range 10 to 45 feet

d. Duration 20 seconds to 2 minutes

e. Hose length 50 to 100 feet

f. Operation - Internal pressure - expellant dry air, nitrogen, carbon dioxide or inert gas

9. Multi-Purpose Base Dry Chemical Extinguishers

a. Size 2½ to 30 pounds

b. For use on Class A - B - C Fires (Not recommended for use on Class D Fires unless the unit has been designed for this purpose as indicated on Extinguisher label.)

c. Range 5 to 20 feet

d. Duration 10 to 25 seconds

e. Operation - Internal Pressure - expellant dry air, nitrogen, carbon dioxide, inert gas

INSTRUCTORS NOTES	TEACHING POINTS
Ref: pp. 172-189	D. Dry Chemical 9. Multi-Purpose Base Dry Chemical Extinguishers CAUTION: CARE SHOULD BE TAKEN TO AVOID CONTAMINATION OF ANY TYPE DRY CHEMICAL WITH MULTIPURPOSE TYPE.
Refer to HANDOUT #7	E. Dry Powder a. Size - varies b. For use on Class D Fires c. Range - varies d. Duration - varies e. each metal has a specific agent to use f. Operation - cartridge or scoop Note; Fires of high intensity may occur in certain metals. Ignition is generally the result of frictional heating, exposure of metal to moisture, or exposure to fire in other combustible materials. The greatest hazard exists when these metals are in the molten state or in finely divided forms of dust, turnings or shavings. While reasonable precautions in handling and storage will prevent ignition of these metals, there are occasional fires which must be controlled or extingushed.
Ref: pp. 151-170 4-16 PORTABLE EXTINGUISHERS 4-16.4	I. Rating of Extinguishers Portable fire extinguishers are classified according to their intended use on four classes of fires: CLASS A CLASS B CLASS C CLASS D In addition to the letter rating, extinguishers also receive a numerical rating. The number preceding the letter designates the potential size fire the extinguisher can be expected to supress.

INSTRUCTORS NOTES

TEACHING POINTS

Ref; pp. 151-170

I. Rating of Extinguishers

A. Testing agencies

1. UL - Underwriters Laboratories Inc.

2. UL - Underwriters Laboratories of Canada

3. FM - Factory Mutual Insurance Company

4. USCG - United State Coast Guard

NOTE: For the purposes of this course we will discuss the rating procedures used by Underwriters Laboratories Inc.

These ratings consist of both a numeral and letter for extinguishers intended for use on:

Class A Fires
Class B Fires

Extinguisher for use on:

Class C Fires

only receive the letter rating since the electrical will consist of either CLASS A, CLASS B, or both components.

Extinguishers for use on:

Class D Fires

do not contain a numerical rating. The effectiveness of the extinguisher on CLASS D metals is detailed on the face plate.

B. CLASS A RATINGS

Extinguishers for the control of this type of fire receive ratings from:

1-A thru 40-A

The numerical rating reflects the relative quantity of fire that can be extinguished by a certain size fire extinguisher.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 151-170

Refer to HANDOUTS #1-2-3

B. CLASS A RATINGS

For example:

1¼ gallons are required for a 1-A rating

2½ gallons or twice the amount of a 1-A rated extinguisher are required for a 2-A rating.

A dry chemical extinguisher rated 10-A is equivalent to five (5) 2½ gallon units rated 2-A.

There are three types of Class A fires that must be extinguished for an extinguisher to receive a 1-A through 6-A rating:

1. Crib fires 2-A = 78 pieces

2. Partition fires = 144 square feet

3. Excelsior fire

C. CLASS B RATINGS

Extinguishers for the control of this type of fire receive ratings from:

1-B through 640-B

The tests used to determine the rating of Class B extinguishers consist of burning the flammable liquid n-Heptane in square steel pans.

The pan contains two (2) inches of n-Heptane over enough water to permit a six (6) inch depth in the pan.

The steel pan itself can not be less than eight (8) inches deep. The pans vary in size, and the surface area (in square feet) which can be extinguished determines the rating awarded.

Underwriters Laboratories always use an expert operator in conducting the tests.

The pan size that must be consistently extinguished by a certain unit is determined by the expert operator.

However the numerical rating of the extinguisher is applied assuming useage by a non-expert or untrained operator.

INSTRUCTORS NOTES	TEACHING POINTS
Ref: pp. 151-170	C. CLASS B RATINGS For example: A unit rated 60-B can extinguish a flammable liquid in a pan with 150 square feet when used by an expert operator. The non-expert operator can be expected to extinguish 40 percent of 150, or 60 square feet of fire. Consequently, the rating of 60-B is applied to the unit. The numerical rating on the Class B extinguisher basically serves two (2) purposes: 1. It is approximately indicative of the relative fire extinguishing potential of various sizes of the different types of extinguishers suitable for Class B fires. 2. It is an approximate indication of the square foot area of deep layer flammable liquid fire that a non-expert operator can extinguish. D. CLASS C RATINGS Extinguishers for the control of this type of fire do not receive a numerical rating. The extinguishing agent is tested only for electrical non-conductivity. If the agent meets the test requirements it is assigned a CLASS C letter rating. No CLASS C rating is provided unless the extinguisher also has an established numerical CLASS A,B, or both rating. The CLASS C rating is provided in conjunction with a rating previously established for CLASS A and/or CLASS B fires. E. CLASS D RATINGS Test fires for establishing CLASS D ratings vary for the type of combustible metal being tested.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 151-170

E. CLASS D RATINGS

Several factors are considered during each test, including:

1. Reactions between metal and agent

2. Toxicity of agent

3. Toxicity of fumes produced and products of combustion

4. Burnout of metal instead of extinguishment

When an extinguishing agent is determined to be safe and effective for use on a metal, the details of instruction are included on the facepiece of the extinguisher, although no numerical rating is applied.

II. Selection of Suitable Extinguishers

A. Hazards to be Protected

Building construction and interior contents determine extinguishers needed.

1. Combustible building construction will require fire extinguisher suitable for CLASS A fires.

a. water types
b. foam
c. loaded stream
d. multipurpose dry chemical

If the occupancy hazards of a building create potential CLASS B,C, or D fires, suitably rated extinguishers should be available.

CLASS B hazards require extinguishers containing:

a. Halon
b. Carbon Dioxide
c. Dry Chemical
d. Foam
e. Loaded Stream

CLASS C hazards require extinguishers containing:

a. Halon
b. Carbon Dioxide
C. Dry Chemical

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 151-170

II. Selection of Suitable Extinguishers

A. Hazards to be Protected

CLASS D hazards require extinguishers containing:

Agents approved for use on the combustible metals present.

2. Occupancy Hazards

The area to be protected should be determined as either a:

LIGHT HAZARD

ORDINARY HAZARD

EXTRA HAZARD

in selecting type, size and number of extinguishers.

LIGHT HAZARD - a situation where the amount of combustibles or flammable liquids present is such that a fire of small size could be expected.

These may include:

a. offices
b. school rooms
c. churches
d. assembly halls, etc.

ORDINARY HAZARD - a situation where the amount of combustibles or flammable liquids present is such that a fire of moderate size may be expected.

These may include:

a. mercantile storage and display
b. auto showrooms
c. parking garages
d. light manufacturing
e. warehouses not classified as extra hazard
f. shop areas, etc.

INSTRUCTORS NOTES | TEACHING POINTS

Ref; pp. 151-170

II. Selection of Suitable Extinguishers

A. Hazards to be Protected

2. Occupancy Hazards

EXTRA HAZARD - a situation where the amount of combustibles or flammable liquids present is such that fires of severe magnitude may be expected.

These may include:

a. woodworking
b. auto repair
c. aircraft servicing
d. warehouses with high piled combustibles
e. and processes such as:

(1) flammable liquid handling
(2) painting
(3) dip tank operations

Refer to HANDOUT #4

B. Distribution of Extinguishers

CLASS A HAZARDS

Basic Minimum Extinguisher Rating for Area	Maximum Travel Distance to Extinguishers	Area to be Protected Per Extinguisher
1 - A	75 ft.	light-3,000 sq. ft.
2 - A	75 ft.	light-6,000 sq. ft. Ordinary -3,000 sq. ft.
3 - A	75 ft.	light-9,000 sq. ft. Ordinary-4,500 sq. ft. extra-3,000 sq. ft.
4 - A	75 ft.	light-11,250 sq. ft. Ordinary-6,000 sq. ft. extra-4,000 sq. ft.
6 - A	75 ft.	light-11,250 sq, ft. Ordinary-9,000 sq. ft. extra-6,000 sq. ft.

The protection requirements in the table may be fulfilled by several extinguishers of lower rating for ordinary or extra hazard occupancies, subject to approval by the authority having jurisdiction.

INSTRUCTORS NOTES

TEACHING POINTS

Ref; pp. 151-170

Refer to HANDOUT #5

II. Selection of Suitable Extinguishers

B. Distribution of Extinguishers

CLASS B HAZARDS

The following table is for flammable liquid fires of shallow depth (less than 1/4 inch liquid).

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Travel Distance to Extinguishers
Light	4 - B	50 ft.
Ordinary	8 - B	50 ft.
Extra	12 - B	50 ft.
(for extinguishers labeled before June 1, 1969)		
Light	5 - B	30 ft.
	10 - B	50 ft.
Ordinary	10 - B	30 ft.
	20 - B	50 ft.
Extra	30 - B	30 ft.
	40 - B	50 ft.
(for extinguishers labeled AFTER June 1, 1969)		

CLASS C HAZARDS

Extinguishers with CLASS C ratings are required where energized electrical equipment may be encountered and where a nonconducting extinguishing agent is needed.

Since the fire itself may be a CLASS A or a CLASS B hazard, the extinguishers are to be sized and located on the basis of the anticipated CLASS A or B hazard.

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 151-170

II. Selection of Suitable Extinguishers

B. Distribution of Extinguishers

CLASS D HAZARDS

The availability of extinguishers for CLASS D hazards is particularly important because using the wrong extinguisher can instantly increase fire intensity and/or spread the flame.

The amount of extinguishing agent needed is normally measured by the surface area of the combustible metals. likely to become involved plus the potential severity of the fire.

Refer to HANDOUT #6-7

The distribution of extinguishers for CLASS D hazards should be done with a complete understanding of the agent and the metal to be protected.

METAL FIRE EXTINGUISHERS
GUIDE TO EXTINGUISHING CAPACITY - U.L. RATINGS

HAZARD	APPROX. HAZARD SIZE Area Square Feet	Quantity lbs. of Metal
Magnesium Chips		6
Sodium Spill- Depth over 1/2 inch	5 3	5 6
*Potassium Spill- Depth over 1/2 inch	5 3	5 6
*Sodium Potassium Alloy-Spill	3	2

* When extinguishing potassium or sodium-potassium alloy in depths over 1/2 inch use grating. For details contact the manufacturer.

III. Marking of Extinguishers

A. Extinguishers and/or extinguisher locations may be marked to indicate the suitability of the extinguisher for a particular class of fire.

They may be applied by decal, painting or similiar methods that are durable and legible.

INSTRUCTORS NOTES

TEACHING POINTS

Ref; pp. 151-170

III. Marking of Extinguishers

A. Where markings are applied to the extinguisher, they should be located on the front of the shell above or below the extinguisher nameplate.

Markings applied to extinguishers should be of a size and form to be easily legible at a distance of at least 3 feet.

When placed on walls, posts or hung from the ceiling in the vicinity of extinguishers, they should be of size and form easily legible at a distance of at least 25 feet.

1. CLASS A MARKINGS

Extinguishers suitable for CLASS A fires should be identified by a triangle containing the letter "A". If colored, the triangle should be GREEN.

2. CLASS B MARKINGS

Extinguishers suitable for CLASS B fires should be identified by a square containing the letter "B". If colored the square should be RED.

3. CLASS C MARKINGS

Extinguishers suitable for CLASS C fires should be identified by a circle containing the letter "C". If colored the circle should be BLUE.

4. CLASS D MARKINGS

Extinguishers suitable fro CLASS D fires should be identified by a five-point star containing the letter "D". If colored the star should be YELLOW.

IV. Inspection of Fire Extinguishers

A. Firefighters are frequently required to inspect fire extinguishers.

Two main factors which determine a fire extinguishers worth and will justify its purchase and installation are:

1. its serviceability

2. its accesibility

INSTRUCTORS NOTES

TEACHING POINTS

Ref: pp. 151-170

IV. Inspection of Fire Extinguishers

A. An inspector should look for the following items:

1. Check acessibility and proper location
2. Check tag for date of last recharge or inspection
3. Check nozzle for obstruction and operation
4. Examine for corrosion (leaks at seams) or mechanical damage
5. Check lockpin and seal
6. Determine if full (water level, pressure gauge or weight
7. Examine condition of hose and hose coupling
8. Check horns for cracks, dirt or grease accumulations
9. Date of this inspection and initials of inspector should be placed on tag

V. Obsolete Extinguishers

A. In 1969 the manufacture of all inverting type of extinguishers was discontinued in the United States.

These include:

1. Soda-Acid
2. Foam
3. Cartridge operated water
4. Loaded stream

It is estimated that there are still several million of these extinguishers in use. Some of the disadvantages associated with these extinguishers are:

1. They are extremely good conductors of electrucity
2. They cannot be turned off once activated
3. The agent is more corrosive than plain water
4. They are potentially dangerous to the operator during use. If the discharge hose becomes blocked the can build up pressures in excess of 300 psi and explode causing serious injury or death to the operator.

UNIT QUIZ

1. Match the class of fire to the correct symbol.

a. Class A _____	1. Blue circle
b. Class B _____	2. Green triangle
c. Class C _____	3. Red Square
d. Class D	4. Yellow star

2. Draw and label the fire tetrahedron

3. List the extinguishing principle of the following.

a. Water _____

b. Liquified gas _____

c. Dry Chemical _____

d. Dry powder _____

4. The maximum travel distance to an extinguisher rated 1-A is:

(Circle the letter at the correct answer)

a. 65 ft.

b. 45 ft.

c. 75 ft.

d. 35 ft.

5. An occupancy where the amount of combustibles or flammable liquids present is such that a fire of small size could be expected is rated as:

(Circle the letter at the correct answer)

a. Ordinary hazard

b. Light hazard

c. Extra hazard

6. A dry chemical extinguisher rated 10-A will extinguish ____ times as much fire as an extinguisher rated 2-A.

   (Circle the letter at the correct answer)

   a. 2

   b. 4

   c. 3

   d. 5

   e. 7

7. Match the Class of Fire to the fuels listed.

   a. Class A _____ 1. Flammable liquids

   b. Class B _____ 2. Ordinary combustibles

   c. Class C _____ 3. Combustible metals

   d. Class D _____ 4. Energized electrical equipment

8. Name the three physical states of fuel.

   a. _____

   b. _____

   c. _____

9. The principle which most closely describes how Dry Chemical extinguishes fire is:

   (Circle the letter at the correct answer)

   a. Fuel removal

   b. Cooling and quenching

   c. Smothering

   d. Inhibition of chain reaction

10. Which of the following agents <u>should not</u> be used on a CLASS C fire. Circle the letter at the correct answer

    a. Foam

    b. Dry chemical

    c. Halon 1301

    d. Carbon dioxide

11. With fire involving a Class A material, the most desirable agent to use would be:

    (Circle the letter at the correct answer)

    a. liquified gas

    b. ordinary dry chemical (sodium bicarbonate base)

    c. water based

    d. carbon dioxide

12. Class A symbol is a: (Circle the letter at the correct answer)

    a. Red square

    b. Green triangle

    c. Blue circle

    d. Yellow star

13. Your engine has a 30-pound ABC dry chemical on it. The extinguisher is rated 6A; 30B; C. Match the following statements which best describe the rating of the preceding extinguisher. Place the letter or letters on the line preceding the rating:

    _____ 1. 6A

    _____ 2. 30B

    _____ 3 C

14. List three items to be checked during a visual inspection of a fire extinguisher.

    1._____

    2._____

    3._____

15. Name the three sides of the Fire Triangle

    1._____

    2._____

    3._____

16. In the Tetrahedron Theory, which of the following is called the reducing agent:

    Circle the letter at the correct answer)

    a. fuel

    b. heat

    c. oxygen

    d. chemical chain reaction

17. Stored pressure water extinguishers are designed to be carried in _____ position and the operator is cautioned to keep the _____ in his hand at all times:

    (Circle the letter at the correct answer)

    a. inverted-nozzle

    b. upright-hose

    c. horizontal-release grip

    d. vertical-pin

18. The operating principle of the carbon dioxide extinguisher is:

    (Circle the letter at the correct answer)

    a. chemical reaction

    b. stored pressure

    c. cartridge operated

    d. internal pressure

19. The minimum basic extingusher rating for a Class B Extra Occupancy Hazard is:

    (Circle the letter at the correct answer)

    a. 4-B, 8-B

    b. 12-B

    C. 5-B, 10-B

    d. 20-B, 40-B

20. Extinguishers suitable for class C fires should be marked with a _____ colored _____

    (Circle the letter at the correct answer)

    a. Square-Red b. Triangle-Green C. Circle-Blue d. Star-Yellow

Answer Key

1. a. 2

   b. 3

   c. 1

   d. 4

2. Oxygen Fuel

   Heat Chemical Reaction

3. Water- quenching-cooling
   Liquified gas - smothering
   Dry chemical - Inhibition of chain reaction
   Dry powder - Inhibition of chain reaction - smothering

4. 75 ft.

5. b.

6. d

7. a. 2

   b. 1

   c. 4

   d. 3

8. Solid
   Liquid
   Gas

9. 9. d

10. a.

11. c

12. b

13. 1. A

    2. F,H

    3. G, C

14. Accessibility - proper location
    check tag for date of last recharge or inspection
    Check nozzle for obstructions and operation
    Examine for corrosion or mechanical damage
    Check lockpin and seal
    Determine if full
    Examine condition of hose and hose coupling
    Check horns for cracks, dirt or grease accumulations
    Place date of inspection and initial tag

15. Heat - Fuel - Oxygen

16. a

17. b. upright-hose

18. d

19. d

20. c Circle-Blue

Classification and Rating	Test Panel Size Feet	Gallons Fuel Oil Applied	Total Pounds Excelsior For Windows
1-A	8 x 8	1	10
2-A	10 x 10	2	20
3-A	12 x 12	3	30
4-A	14 x 14	4	40
6-A	17 x 17	6	60

WOOD PANEL TEST

Classification and Rating	Weight of Excelsior (Pounds)	Test Area Feet & Inches
1-A	6	2'10" x 5'8"
2-A	12	4"0" x 8'0"
3-A	18	4'11" x 9'9½"
4-A	24	6'0" x 10'8"
6-A	36	6'11" x 13'11"

EXCELSIOR TEST

Classification and Rating	No. of Members	Normal Size and Length of Members (Inches)	Arrangement of Wood Members
1-A	50	2 x 2 x 18 3/4	10 layers 0f 5
2-A	70	2 x 2 x 24	13 layers of 6
3-A	98	2 x 2 x 28 3/4	14 layers of 7
4-A	120	2 x 2 x 31 1/4	15 layers 0f 8
6-A	153	2 x 2 x 36	17 layers of 9
10-A	209	2 x 2 x 44 1/2	19 layers of 11
20-A	160	2 x 2 x 60	10 layers of 15 on edge 1 top layer of 10 flat
30-A	192	2 x 2 x 72	10 layers of 18 on edge 1 top layer of 12 flat
40-A	224	2 x 2 x 84	10 Layers of 21 on edge 1 top layer of 14 flat

WOOD CRIB TEST

UNDERWRITERS' LABORATORIES CLASS B RATING SYSTEM			
Classification and Rating	Minimum Effective Discharge Time (Seconds)	Pan Size Sq. Feet (Inside)	Approximate Gallons of Gasoline Used
1-B	8	2½	3¼
2-B	8	5	6¼
5-B	8	12½	15½
20-B	11	50	65
30-B	13	75	95
40-B	17	100	125
60-B	20	150	190
80-B	26	200	250
120-B	31	300	375
160-B	40	400	500
240-B	48	600	750
320-B	63	800	1000
480-B	75	1200	1500
640-B		1600	2000

EXTINGUISHER CLASSIFICATION

EXTINGUISHER TYPE AND SIZE	CLASSIFICATION
1. DRY CHEMICAL	
A. Ammonium Phosphate Base (ABC)	
1-5 lbs.	2 to 10-B:C
2½-8½ lbs.	1 to 3-A and 10 to 40-B:C
9-17 lbs.	2 to 4-A and 10 to 60-B:C
17-30 lbs.	3 to 20-A and 30 to 80-B:C
50-300 lbs. (Wheeled)	20 to 40-A and 60 to 240-B:C
B. Potassium Bicarbonate Base (Purple K)	
1-2 lbs.	1 to 5-B:C
2½-5 lbs.	5 to 20-B:C
5½-10 lbs.	10 to 60-B:C
16-30 lbs.	40 to 80-B:C
125-300 lbs. (Wheeled)	80 to 320-B:C
C. Sodium Bicarbonate Base (Ordinary(	
1 lb.	1-B:C
1½-2½ lbs.	2 to 5-B:C
2 3/4-5 1/2 lbs.	5 to 10-B:C
7½-30 lbs.	10 to 60-B:C
75-350 lbs. (Wheeled)	40 to 240-B:C
D. Potassium Bicarbonate Urea Base (Monex)	
5-11 lbs.	40 to 80-B:C
17-19 lbs.	120-B:C
175 lbs. (Wheeled)	480-B:C
2. CARBON DIOXIDE	
2½-5 lbs.	1 to 5-B:C
10-15 lbs.	2 to 10-B:C
20 lbs.	10-B:C
50-100 lbs. (Wheeled)	10 to 40-B:C
3. HALOGENATED EXTINGUISHING AGENTS	
A. Bromotrifluoromethane (Halon 1301)	
2½ lbs.	2-B:C
4½ lbs.	5-B:C
B. Bromochlorodifluoromethane (Halon 1211)	
2-4 lbs.	2 to 5-B:C
5½-9 lbs.	10-B:C

EXTINGUISHER CLASSIFICATION	
EXTINGUISHER TYPE AND SIZE	**CLASSIFICATION**
4. WATER	
1½ gal.	1-A
2½ gal.	2-A
4 gal.	3-A
5 gal.	4-A
5. WATER (ANTIFREEZE CALCIUM CHLORIDE	
1½-1½ gal.	1-A
2½ Gal.	2-A
33 Gal. (Wheeled)	20-A
6. WATER (WETTING AGENT)	
25 gal. (Wheeled)	10-A
45 gal. (Wheeled)	20-A
7. WATER (SODA ACID)	
1½-2½ gal.	1-A
2½ gal.	2-A
17 gal (Wheeled)	10-A
33 Gal. (Wheeled)	20-A
8. LOADED STREAM	
2½ gal.	2 to 3-A and 1-B
33 Gal. (Wheeled)	20-A
9. FOAM	
1½-1½ gal.	1-A:2-B
2½ gal.	2-A:4-B to 2-A:6-B
5 gal.	4-A:6-B
17 gal. (Wheeled)	10-A;10-B to 10-A:12-B
33 Gal. (Wheeled)	20-A:20-B to 20-A:40-B

DISTRIBUTION FOR CLASS A HAZARDS

BASIC MINIMUM EXTINGUISHER RATING FOR AREA	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS	AREAS TO BE PROTECTED PER EXTINGUISHER		
		LIGHT	ORDINARY	EXTRA
1-A	75 ft.	3,000 Sq. Ft.		
2-A	75 ft.	6,000 Sq. Ft.	3,000 Sq. Ft.	
3-A	75 ft.	9, 000 Sq. Ft.	4,500 Sq. Ft.	3,000 Sq. Ft.
4-A	75 ft.	11,250 Sq. Ft.	6,000 Sq. Ft.	4,000 Sq. Ft.
6-A	75 ft.	11,250 Sq. Ft.	9,000 Sq Ft.	6,000 Sq. Ft.

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS
LIGHT	4-B	50 ft.
ORDINARY	8-B	50 ft.
EXTRA	12-B	50 ft.

(For extinguishers labeled before June 1, 1969

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS
LIGHT	5-B 10-B	30 ft. 50 ft
ORDINARY	10-B 20-B	30 ft. 50 ft.
EXTRA	20-B 40-B	30 ft. 50 ft.

(For Extinguishers labeled after June 1, 1969

METAL FIRE EXTINGUISHERS

GUIDE TO EXTINGUISHING CAPACITY - UL RATINGS

HAZARD	APPROXIMATE HAZARD SIZE AREA SQUARE FEET	QUANTITY Lbs. OF METAL
Magnesium Chips		6
Sodium Spill	5	5
Depth over 1/2 inch	3	6
*Potassium Spill	5	5
Depth over 1/2 inch	3	6
*Sodium Potassium Alloy - Spill	3	2

* When extinguishing potassium or sodium-potassium alloy in depths over 1/2 inch use grating. For details contact the manufacturer.

EXTINGUISHING AGENT	USE ON	DO NOT USE ON	STORED	METHOD OF APPLICATION
G-1 Powder	Mg,Na,K,ti, Li,Ca.Zr,hf, Th,U,Pu Special applications on powder fires in Al,Fe,Zn	Na on vertical surfaces K or Na-K alloy in depth	Cardboard tubes or metal pails	Applied with hand scoop or shovel. Spread evenly over surface of fire to sufficient depth to smother fire. If on combustible surface, cover fire with powder, shovel burning material onto another layer of powder, add powder as needed.
Met-L-X Powder	mg,Na,K, Na-K,Zr,,U, Ti, and powdered Al	K or Na-K alloy in depth Li fire in depth	Sealed container or extinguishers (30 lb., 150 and 300 lb. wheeled extinguishers	Fully open nozzles and cautiously apply thin layer of agent from distance; Once controlled, use nozzle valve to throttle the stream to produce a soft heavy flow. Completely cover with heavy layer.
Na-X-Powder	Na		50 lb. pails, 30 lb., 150 lb. and 350 lb. wheeled extinguishers.	Aim nozzle and press handle or use scoop
T.E.C. Powder	Na,K,Na-K, U,PU		Extinguisher,cans	Expel from extinguisher use scoop or shovel

EXTINGUISHING AGENT	USE ON	DO NOT USE ON	STORED	METHOD OF APPLICATION
FOUNDRY FLUX	Mg	Chip fires in machine shops	Covered steel drums	In open fires, apply with hand scoop or shovel
Lith-X-Powder	Li,Mg,Zr,chip fires,Na,Na-K		Extinguisher	Same as Met-L-X
TMB Liquid	Mg,Zr,Ti	Li and Na-K alloy,Na	2½ gallon stored pressure extinguisher	Aim nozzle and press handle. Expect an initial heat flash from chemical breakdown, then extinguishment.
Pyromet Powder	Na,Ca,Zr,Ti, Mg, Al		Extinguisher	Aim nozzle and press handle. Allow powder to fall gently.

METAL FIRE EXTINGUISHING AGENTS

Key to Abbreviations:

Al - Aluminum	Ti - Titanium
Ca - Calcium	Zn - Zinc
Li - Lithium	Fe - Iron
Mg - Magnesium	Hf - Hafnium
K - Potassium	U - Uranium
Na - Sodium	Th - Thorium
Zr - Zirconium	Pu - Plutonium